THE PRESERVATION OF WOOD, STEEL AND GALVANIZED SURFACES

....THE....

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—OF—

WOOD, STEEL AND GALVANIZED SURFACES.

PUBLISHED BY

The Goheen Manufacturing Co.,

CANTON, OHIO, U. S. A.

FOURTH EDITION.

Paints for Wood Surfaces.

The object of paint is twofold: To protect the surface and incidentally to beautify. A good paint must spread easily, smoothly and evenly under the brush. It must retain its color and not change in composition when exposed to sun and storm or the many gases arising from the combustion of coal, etc., but must in short—WEAR.

Whatever paint embodies these qualities, is a good, reliable paint, no matter what it may be called, let it be White Lead paint, Zinc paint or any other. If the manufacturer makes a paint possessing the virtues indicated, he is making good paint.

There are many painters who will tell you without any hesitation, that White Lead and Linseed Oil make the most permanent paint for wood, for the simple reason they do not know any better, their knowledge of pigments being limited. There are, however, other pigments than White Lead which are much more permanent, and by a judicious combination of them with White Lead and Linseed Oil, a durable paint is made. By the use of modern machinery in mixing, grinding and manipulating, a uniform paint is obtained unlike the old and antiquated methods of hand mixing and soaking of paint pigments, indulged in by painters in years gone by.

There is hundreds of tons of so called "Pure White Lead" used by painters every year (in some cases giving the best of satisfaction and results,) which in truth does not contain one particle of White Lead; it remains therefore for the paint manufacturer to produce the proper working and wearing paint to suit the requirements, and allow the consumer to designate it by whatever name suits his peculiar fancy.

The BEST known of all paint pigments is

WHITE LEAD.

White Lead is probably one of the oldest paint pigments known. We find Dioscorides four centuries before Christ, stating it was manufactured at that time by the exposure of metallic lead to the vapors of vinegar. Theophratus, Pliny and Vitruvius also speak of it being manufactured during their time. For years it was considered an acetate of lead and called by various names, such as Cerusa and Cerosa, however, in 1775 Bergman discovered the true composi-

tion of White Lead, viz: Basic Carbonate of Lead, which in its pure state contains 70 per cent carbonate of lead and 30 per cent hydrate of lead. The Dutch carried on the manufacture of this article for many years, and in fact the Old Dutch process of corrosion (which takes from 3 to 5 months to convert the metallic lead to the white lead of commerce) is still in use in the principal white lead factories of the world, with one or two exceptions, notably, the most successful, quick process of corrosion which is in use by the Carter White Lead Co. of Omaha and Chicago, who produce a White Lead equal, if not superior, to any manufactured by the "Old Dutch" process. The Dutch process is carried on in the following manner: The metallic lead is melted and cast into small perforated pieces about six inches in diameter (which are called buckles); these buckles are placed in earthen pots containing about one pint of diluted vinegar, then placed in layers of about 1000 pots each, the pots are covered with boards and tan bark. The fermentation of the tan bark combined with the vapors from the vinegar, corrodes the metallic lead. At the end of four to five months, corrosion is completed and the white substance is ground in water, dried and powdered and placed on the market as dry White Lead. Much of the White Lead sold as "Strictly Pure," "Pure," etc., is far from being pure. Adulterants of various kinds are used, principally Sulphate of Barium, known in commerce as Barytes.

The common test of White Lead is with the blow pipe, by taking a piece of charcoal with a small depression in it, and place therein a portion of the White Lead and direct a flame to it by the blow pipe; if the sample is pure, in a few minutes it will be reduced to a leaden mass, if, however, it is adulterated, it will form a Black cinder like substance. Minute quantities of adulteration can be shown by this test. White Lead, therefore, is not a very staple body and is easily changed by heat, as shown by above test, and also easily affected by gases; when exposed to sulphurous vapors turning to a brownish black, being converted from Carbonate of Lead to Sulphide of Lead. As a paint pigment, this is where its weakness occurs, being readily affected by detrimental influences found in Coal smoke, swampy and marshy fogs and vapors. It has been clearly proven by long years of experience, that a mixture of Carbonate of Lead and oxide of zinc produce a more durable paint pigment than Carbonate of Lead alone. The addition of oxide of zinc makes a much firmer paint, thus better throwing off or repelling the detrimental agents which attack Carbonate of Lead, and avoiding checking, blistering and cracking of the paint.

Unbiased practical painters agree that a carbonate of lead and oxide of zinc with Linseed oil produce a much more durable paint than straight lead alone; Lead has easy working qualities, Zinc the spreading capacity and permanency, besides zinc will carry a greater amount of oil than Carbonate of Lead, and

Linseed oil has a great deal to do with the durability of paint on wood surfaces. About 25000 tons of Oxide of zinc are used annually for paint purposes in America, and its use in this direction increases every year, showing clearly that it has proved its qualities as a good paint pigment, when used in proper proportions. It should be understood, that Oxide of Zinc is not used to reduce the manufacturer's cost of the paint, as Pure Oxide of Zinc costs the manufacturer of prepared paints, as much as Carbonate of Lead, and if imported Zinc is used (which is considered much purer and whiter than American brands) the cost is twice that of Carbonate of Lead.

The highly poisonous character of White Lead is probably one of the worst features in the use of it as a paint, more especially on interior of sleeping and living rooms, factories, etc. Many peculiar ailments have been directly traced to old dusty and crumbled white lead paint. The sanitary commissions of France have disposed entirely of the use of White Lead in all their painting specifications, being convinced of its dangerous character, after having given the matter most careful investigation for the last twenty years or more. As a paint pigment, white lead has certainly many shortcomings, and so this is equally true of oxide of zinc when applied alone as a paint, but a proper combination of White Lead and Oxide of Zinc with pure Linseed Oil, produces the best and most desirable paint for the protection of wood surfaces.

PRIMING OR FIRST COATING.

Pure Linseed Oil when combined with proper pigments and colors, is admitted to be the best and most suitable paint for painting and preserving wood. Linseed Oil paint of any character *will not adhere to a wet surface* or on unseasoned wood, therefore before the paint is applied the surface should be thoroughly dry ; all knots and sappy places should be coated with shellac varnish to seal the rosin and pitchy matter in the wood and keep it from the paint, otherwise the paint will scale off. The priming or first coat is the most important of all, as it supplies the base or foundation for subsequent coats. The more the first coat is brushed out, the better the wood is filled and more permanently will the paint adhere. Paint for priming new woodwork should contain more linseed oil than the subsequent coatings, but too much oil is equally as bad as too little in the priming of wood, and must be guarded against. In repainting, this same rule applies where the lumber is dry and weatherbeaten, the first coat in repainting should contain more linseed oil than in the subsequent coats. "There is a time to laugh and a time to cry," so is there a time to paint.

Exterior painting should not be carried on in damp, frosty or foggy weather, good results cannot be expected from work done under these circumstances. New work should have three coats of paint and the paint brushed out, not slopped or flowed on. Good brushes and plenty of judicious elbow-grease give the best results. Painting cannot be hurried and give satisfaction, time between coats is absolutely necessary, allowing each coat not only to dry thoroughly, but to harden. The use of driers should be avoided at all times in paint. Rapidly drying paint is not durable. There is no substitute for linseed oil; the use of substitute oil, turpentine, benzine, rosin and petroleum oils in paints, ruin the durability and usefulness. Unfortunately much of the ready-mixed paint foisted on the unwily consumer contains many adulterations of the above class, and consequently time and money is wasted in their use. It is true economy to apply only good paint, it does not cost any more to apply, and once applied will give satisfaction, leaving a firm base for repainting. Cheap adulterated paints do not give a proper base for repainting, the consequence is obvious.

A linseed oil paint will not adhere to a surface painted with coal tar or petroleum mixtures, therefore in painting work, it behooves the owner or architect to look carefully into the selection of his paint for first coating.

In repainting old work, dust, grease, dirt and scaly paint should be removed either by scraping, washing, or burning off. Paint will not adhere to dust, grease or dirt. Our ready-mixed paints are made of absolutely pure materials, old-fashioned materials which have given implicit satisfaction for generations, and by long experience we have perfected the mixing, grinding, manipulating and selection of pigments and coloring material so as to produce durable ready-mixed paint.

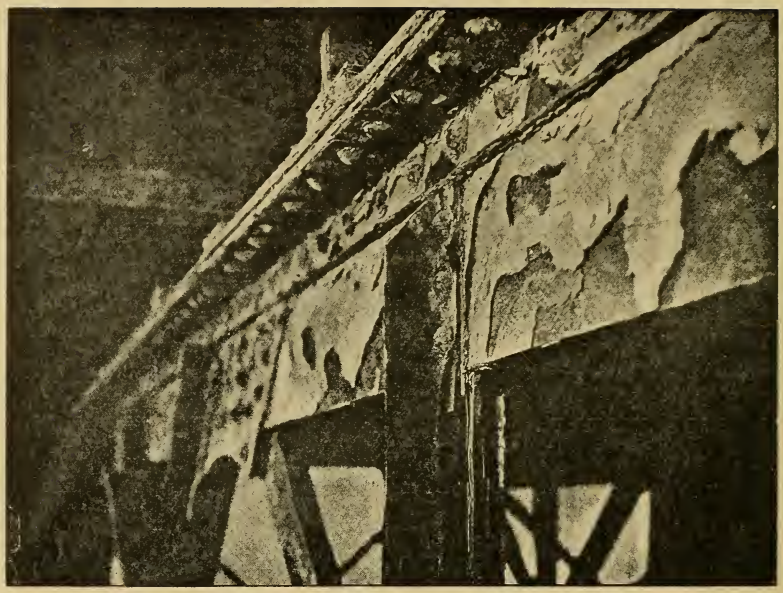
It sometimes occurs that a structure which requires repainting is in such condition that even a pure paint will not give satisfactory results when applied in the ordinary way. We invite correspondence in all such matters, and will gladly suggest the best method to pursue. Pigments containing large percentages of moisture such as ochres, metallic and earth paints should not be used in priming; at all times prime with the same kind of paint to be used in finishing coats.

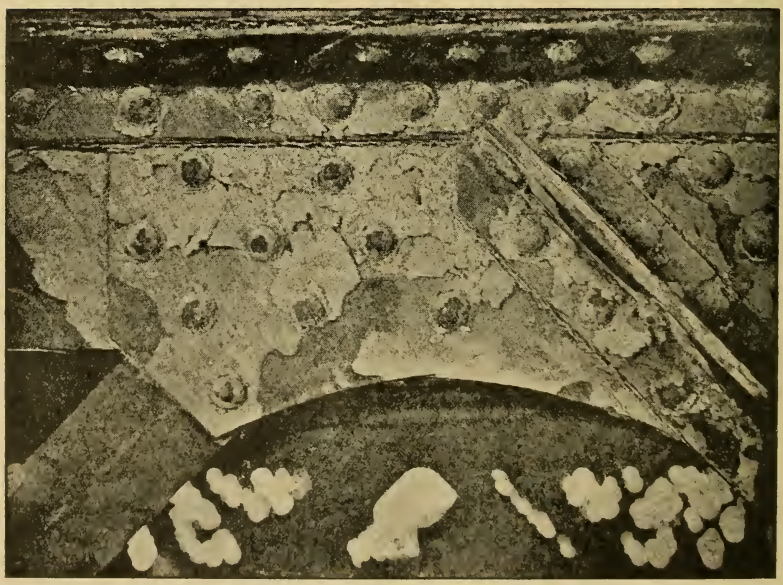
OXIDE OF IRON

Is much used in the form of Venetian reds, metallic brown and metallic red for painting and preserving wooden structures, such as factories, barns, station houses and freight car painting, and when properly selected, prepared, ground and mixed with the most suitable vehicles, gives a lasting and durable paint for the purpose intended. A thoroughly reliable paint is made from Pure Oxide of

Iron properly combined at a much less cost than a lead or lead and zinc paint, although as a rule an oxide of iron paint looses its lustre much quicker than a lead paint, but will wear and protect just as long if not longer. Our oxide of iron paints in the various shades, are selected from the best imported oxides, and only those calculated to be in thorough unison with the medium employed are used, thereby giving durability and satisfaction.

For wood painting, our Magnetic Red or Brown has proved its efficiency, after years of trial, as being the best of all the oxides, for true preservation. This is notably so in freight car work, where the paint is exposed so much, not only to the elements, but to the disintegrating influences of sulphur and smoke from locomotives and the gases in tunnels, etc.





Two sections of a well known viaduct painted with ordinary paint, which shows the ravages of rust caused by the action of locomotive smoke. CARBONIZING COATING protects the metal under these circumstances.

The Preservation of Iron and Steel

Is a subject which has attracted the attention of all classes of professional men, as being one of the most important in modern construction. The advent of steel in the make-up of our large buildings, bridges, etc., and in other work, and the replacing of wooden structures with steel and iron, has caused no end of investigation in regard to the best practical method of protecting the same from rust and corrosion. It is admitted by all authorities that linseed oil is the best medium to employ as a vehicle to carry and hold the pigment in a protective paint, but as to the pigment to be used, we find great variance of opinion from all sides. Some engineers and architects favor Red Lead, others Graphite, Carbon, and probably the majority favor oxide of iron as the best pigment to be used in conjunction with linseed oil, in protecting their work from the ravages of rust and decay, while others do not give the matter any attention, but allow the contractor to use the poorest and cheapest mixture he can find under the guise of paint.

Some most alarming cases of rust in our high buildings have been brought to light recently, and in buildings too, that have only been erected but a few years. It seems imperative that if steel and iron is to be used in our structures, that the day is not far distant, when the Engineer and Architect will have to pay much more attention to the protecting of it than he has done heretofore, and abolish the use of cheap, useless material on their work, which aggravates rusting and decay rather than retarding it. *It is also well known that the steel as manufactured in structural shapes of today is a much harder body to protect from rust, than the iron used years ago, and consequently requires special care in the matter of paint.*

THE FOUNDATION OF PROTECTION

Is cleanliness; this is unquestionably the most important primary factor towards preservation. A surface to be painted must be clean, free from moisture, dirt, grease, flash scale and rust. When we say free we mean *perfectly clean.* This can be attained by the use of the "Sand Blast" which within the last few years has proved a most useful invention in cleaning of iron and steel from rust and flash scale.

One of the best methods of cleaning the work from shop grease is by washing thoroughly with Soda Lye, thereafter removing the last traces of Lye with liberal applications of clean water, then wipe dry with cloths. Rust can also be effectually removed by the use of steel brushes, which readily removes all the loose rust, and where rust spots are deep seated, apply heat from an ordinary painter's torch. In a few seconds, the rust by means of the heat is converted into peroxide of iron, which can be easily dusted off, and in repainting old structures, where the paint has scaled badly, the sand blast should be used in removing it, or a strong solution of paint remover and combined scraping with steel scrapers and thorough cleansing with clean water and drying before painting. The architect, engineer and structural builder may say, that this cleaning and preparatory process adds greatly to the cost of the work, but it is absolutely necessary to obtain the desired protection; no paint of any character will adhere to a wet, greasy, rusty or dirty surface and give satisfaction—this applies to all paint, Red Lead, Graphite, Oxide of iron, Carbonizing Coating or any other protective covering. Unless the surface is in proper condition to receive the paint, it is almost useless to throw away money on paint and painting. It is well to remember the fact, that quality, purity or nature of the paint or coating, will not lessen this cleaning or preparatory work any, it applies to all paint irrespective of their individual durability or merits. If the shop inspectors would pay as much attention to this matter as they do to the other details under their supervision, a large percentage of repainting, after annoyance, and disappointment, would be averted. These facts are acknowledged by practical investigators of the subject, and it therefore behooves the Engineer and Architect, to see that the surface to be painted is thoroughly clean, rather than expect the paint manufacturer to produce some mixture that is physically and chemically an impossibility.

OIL AND PIGMENTS.

Presuming we have obtained a perfectly clean surface, let us glance at the various paints and pigments most commonly in use as protective coatings for structural work. Probably after cleanliness the most important factor is the vehicle or binding medium which is used to carry, hold and bind the pigment to the surface of the metal. Linseed Oil, Liquid japan dryer, Turpentine and Benzine are used less or more in the make up of ordinary paints. Asphaltum, Rosin oils and many other Oils (just as good and costs less) have been tried, but none have proven so satisfactory, durable and economical as Chemically prepared Linseed Oil, and the purer and less contaminated the oil the better the coating with whatever pigment may be employed.

Liquid dryers, Turpentine and Benzine, are only used as aiders to the drying of the Oil, but to use them in connection with Linseed Oil for a Rustless Coating, reduces the life of the oil or the binding medium; hence to the extent that Dryers, Benzine and Turpentine are used, the durability of the paint is reduced. A coating for structural iron and steel should not contain either Liquid dryer, Benzine, Turpentine or Asphaltum, but the Linseed Oil (which is a drying oil) should be so prepared and freed from moisture and slimy, fatty acids found in almost all commercially Pure Linseed Oil. The moisture and *fatty acids* in ordinary commercial Linseed Oil not only retard the drying, but under certain circumstances, causes disintegration of the paint.

The difference between Commercially Pure Linseed Oil and Chemically pure as recognized by chemists, is as vastly different as night is to day. It is, beyond doubt, that Linseed Oil entering into the composition of a rustless coating must be specially prepared for that purpose. Even small traces of *fatty acids* in Linseed Oil are sufficient, when exposed to the air in the form of paint, to become rancid and evolve liberated acids which play havoc with the integrity and life of the paint or coating; therefore it is absolutely necessary to use Chemically Prepared Linseed oil.

The pigments employed in various Iron and Steel coatings are limited in range, the most common are Oxide of Iron, Red Lead and Carbon in its various forms, such as Lampblack, Graphite, etc. Let us glance for a few minutes at each individually:

OXIDE OF IRON

Has been in use as a pigment in paints and coatings for the protection of iron and steel structures for many years, but under many circumstances has failed to lend that protection desired. The cheapness of the material and brilliancy of the color has tended more to its use than the durable qualities of the paint obtained from it. However "Pure Magnetic" oxide of iron containing 95 per cent sesqui-oxide of iron, prepared in Chemically refined Linseed Oil, gives a most valuable metal covering, when price is considered. Owing to the crystalization of Oxide of Iron, the first object of a good pigment is defeated, namely, it attacks the life of the oil. Oxide of Iron does not combine with Linseed Oil at all, the process of drying depending alone on the absorbtion of oxygen by the oil, in which the pigment assists in a purely mechanical way. One writer on the subject of Oxide of Iron as a pigment for metal coatings, goes so far as to pronounce Oxide of Iron, after the most careful investigation, to be actually dangerous for the purpose of protection of structural work. In this we do not altogether coincide, for our experience of twenty years teaches us differently. At the same

time it is a fact, that 95 per cent. of the Oxide of Iron paints are really injurious owing to the contaminations in the native oxide or adulturations used by paint makers. We are safe in saying that two-thirds of the Oxide of Iron paints now on the market contain over 5 per cent of Carbonate of Lime, and it has been clearly demonstrated that any paint containing over 5 per cent Carbonate of Lime is freely attacked by sulphur generated by combustion of coal or other causes, and the paint or coating rapidly becomes disintegrated.

It is therefore conclusive that a pigment used in the composition of a rust-less coating should not contain more than 5 per cent of Carbonate of Lime; this is a point which is almost imperative in the make up of true protective paint. The bright, clear color of many of our Oxide of Iron pigments have doubtless added much to the preference for Oxide of Iron as a structural paint, but our experience has been almost invariably that the brighter the color the less durable the paint.

One other noticeable feature of Oxide of Iron is, that the higher the percentage of sesqui-oxide of iron contained in the Oxide the slower the paint is in drying. This is one objection to Oxide of Iron as a pigment, for we know that the Oxide of Iron must contain a high percentage of sesqui-oxide to give protection, and we also know that a good structural paint should not contain any Liquid dryer, Benzine or Turpentine.

Oxide of Iron paints give very short protection to iron or steel in the presence of sea water; the salts contained therein have a most pronounced effect upon the pigment. In many cases and under certain circumstances, tend to make the metal more susceptable to rust; this fact is clearly demonstrated to the skeptical in the holds of many steel vessels where the paint is exposed to a confined atmosphere, and the chemical changes of bilage water in the lower section of the hold, combined with less or more drainage from the ash boxes of the furnaces and coal bunkers in steam vessels, not to speak of the leakage from various cargoes, often emit gases which are prone to kill the life of ordinary Oxide of Iron paint, and much the same thing takes place with our elevated railroads, where locomotive smoke and drainage from the engines containing sulphur, etc., are washed by rain over the surface painted with ordinary Oxide of Iron paint,—the life of which, when under those circumstances, is very short.

One case in point: We know of a portion of an elevated railroad in New York City having been painted with what we presume a fair quality of Oxide of Iron paint, as recently as October, 1896, and six months after painting presented a most deplorable appearance, and giving no protection to the work at all. A paint of this character is obviously without value as a protective coating under all circumstances. The idea propounded by many manufacturers of other than

Oxide of Iron paints, that Oxide of Iron is rust and consequently produces rust, has long since been exploded.

Oxide of Iron is a ferric-oxide and not hydrated sesqui-oxide of iron. Ferric-oxide or oxide of iron contains about 2 per cent of water in its composition, while iron rust contains 24 per cent, consequently the difference in their composition is at once apparent. "We hold a high grade of Oxide of Iron and chemically prepared Linseed Oil is a very good, durable paint, under certain circumstances."

GRAPHITE.

Graphite as a pigment has come into use within recent years quite extensively as a protecting pigment for iron and steel from rust. The results obtained from Graphite paints have been anything but uniform. The various brands of Graphite giving entirely different results. It is claimed that the deposit of Graphite recently discovered in a section of Canada is the best, while those mining Graphite in Mexico, Ceylon, and various sections of the United States, each and all claiming superiority over one another, therefore we do not wonder at the varying results obtained, as the pigment, according to the miners, varies so much in quality. The ideas advanced by some, that Graphite, when in conjunction with Linseed Oil, so arranges itself on the surface of the metal like so many shingles on the roof of a house or the scales upon a fish, is so ridiculous that we hardly think it necessary to prove scientifically the absurdity of the idea. Graphite has never been found in a perfect state of purity, and could not in its pure state be used as a protective paint. While the pigment Graphite itself is not attacked by acids, alkalies or brine, the oil in the paint is, consequently, a disintegration of the coating when exposed to the action of sulphur, etc.

It is well to remember that whatever pigment is used in a protective coating, let it be Graphite, Red Lead, or any other ordinary paint pigment, that each and every molecule of the pigment is surrounded by the oil or binding medium and (the pigment) does not come in contact with the metal at all.

One of the most objectionable features of Graphite paint is, that it dries too soft and spongy; especially is this objectionable when used on railroad bridges, depots, etc., where the surface coated is exposed to flying particles from fast running locomotives and sand blasts which puncture the paint and lay the surface bare to deleterious agents. Many claim Graphite paint to be much more elastic than any other paint. That may be so, but as there is a limit to the brittleness of a coating, so there must be to the elasticity. Examine under a microscope Graphite paint mixed with Linseed Oil, and it will divulge many of the objectionable features of the paint.

Graphite has *positively no affinity* for Linseed Oil, therefore the many claims made for it are made for the *pigment Graphite*, and not for the mixture of Graphite and Linseed Oil, known as Graphite paint. The assertion, also, that Graphite remains elastic to the last, is in our mind erroneous, and to this we say, we have made thousands of gallons of Graphite paint, but when exposed side by side with other paints, to the rays of the sun, it loses as great a percentage of its elasticity as any other structural iron paint. Graphite paints frequently show an unbroken coating on the metal, but lacking in moisture repelling qualities, underneath the film of paint, rust and corrosion have been going on just the same.

RED LEAD

Has been largely specified on structural iron work, most frequently as a first coat, finishing the work with one or two coats of Oxide of Iron, Graphite or other paints. The fact has been practically and chemically demonstrated that the use of pigments of high specific gravity (such as Red Lead) in first coating are entirely wrong, and that pigments of low specific gravity are the most satisfactory for primary coating of metal. This conclusion has been reached after the most elaborate experiment and research by SPENRATH, the noted French Technical Chemist, and many other equally high authorities on the problem of preservation of iron and steel.

At the same time, it has developed that many pigments of extremely low specific gravities are not altogether suited for the first coatings. Red Lead dries too rapidly and hard, (at the expense of the oil) becoming brittle, and does not allow for the expansion and contraction of the metal, hence cracks appear on the surface, in consequence rusting takes place. There is no pigment we know of within the category of rustless coating pigments, which has such a marked effect upon the oil or binding material. Red Lead is easily attacked by gases generated from decaying vegetable matter and the combustion of coal. Sulphurated hydrogen or locomotive smoke rapidly changes the color of Red Lead *and alters the chemical composition*, disintegrating the paint, causing it to crumble; the result being no longer a rustless coating upon the surface of the metal.

Many mixtures of various pigments with Red Lead have been tried to retard the hard, rapid drying of Red Lead paint, such as "Red Lead and Lampblack," "Red Lead and Yellow Ochre," and many others, but have failed to produce the results desired; especially is this the case in the use of ochre with Red Lead, for the simple reason that yellow ochre contains in its composition, moisture which, while retarding the rapid drying of the Red Lead paint and lending

more elasticity to it, the moisture therein contained under many conditions is freed from the ochre, and most detrimental to the metal covered with it; in fact, aiding the formation of rust and corrosion under the surface of the paint upon the metal.

The specific gravity of a rustless coating has doubtless a great deal to do with the durability of the covering. In many cases we find engineers specifying Red Lead paint, "not to *weigh less than 30 pounds to the gallon*," to be used upon their work, while others specify Graphite paint made up of 2 lbs. dry Graphite and 1 gallon Linseed Oil, the finished paint weighing about 9 lbs. to the gallon. In the first instance, the weight of the pigment predominates to such an extent that we would consider it of being very little value as a protective paint, while on the other hand, in the Graphite paint, the weight of the oil or binding material predominates. A paint for IRON and STEEL *must be so balanced as to give the desired protection.* In the case of Red Lead, the requisite amount of oil or binding material cannot be used, owing to the high gravity of the lead, and produce a desirable coating. Indeed, in most of the cheap paints now offered, the pigment is much greater than the binding material and just to the extent the pigment predominates over the oil, is the life, durability and usefulness of the coating curtailed.

The cost of Red Lead and the difficulty of applying it as compared with other just as efficient and durable paints, is reducing its use daily as a structural paint, combined with the fact that under many circumstances it is devoid of value as a rustless coating.

MISTAKEN EXPERT TESTIMONY ON RED LEAD.

Many of the trade booklets which find their way into the hands of the engineer and structural builder, calculating, as they do, to foist some special brand of paint as being the most permanent protective paint for iron and steel, contain theories, assertions and ideas which, to the careful reader, do not accord with the laws of nature, chemistry or practical demonstration. These false theories eminate from a want of knowledge, misunderstanding, or in an attempt at nulling all other coatings, save the one which they are desirous of selling.

The testimony of others is given in substantiation of the promoter's claims and often they, in turn, not feeling satisfied by giving their "lifelong experience" with the paint under question, seek to turn the laws of chemistry upside down to suit the situation. For instance, in pamphlets issued by combined manufacturers of White and Red Lead under "Red Lead and How to Use It,"

"Concerning Red Lead," "Why and How to Use Red Lead," we find the testimony of what they are pleased to term "expert testimony."

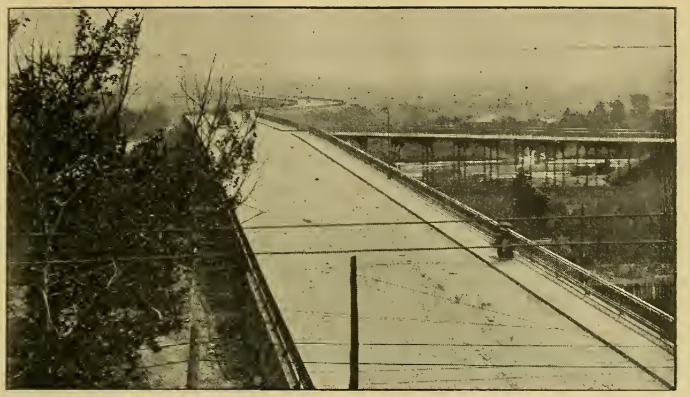
Here is a sample of the "expert testimony" by a bridge engineer, who, after lauding the praises of Red Lead as a structural paint, goes on to assert that "A little spot of rust, *which* is Oxide of Iron, has a tendency to delvelop into a large rust spot, and as *Oxide of Iron is merely rust* mixed with Linseed Oil, etc." With all due deference to the long experience practically with Red Lead, the expert testimony, as far as chemical significance is concerned, falls flat in the estimation of the most uninitiated student of organic or inorganic chemistry—knowing there is as much difference between Hydrated Sesquioxide of Iron (Iron Rust) and Ferric Oxide (Oxide of Iron) as there is between a wooden bridge and one constructed of steel. They are both certainly bridges, but differ entirely in their composition. Suppose, then, that one should so far forget the fundamental principals of chemistry and stretch his imagination so far as to embrace this theory of Oxide of Iron Paint being merely Rust, then a greater and even more absolute fact presents itself, in that RUST (Hydrated Sesquioxide of Iron) when thoroughly ground and mixed with Linseed Oil cannot possibly produce further rust. We find numerous testimonials of this character given in these trade pamphlets.

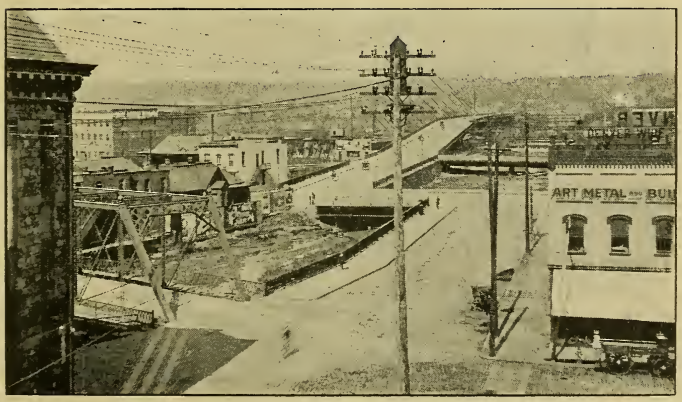
We would simply ask the skeptical to procure a quantity of *Iron Rust*, grind it and mix it with Linseed Oil and apply it as a metal coating. We think that, without again going into the different chemical formulas of Rust and Oxide of Iron (the difference between Oxide of Iron and Iron Rust) will be practically demonstrated.

Another writer, in "Concerning Red Lead," says: "Red Lead, from the fact that it dries up Linseed Oil almost entirely by soaponification, forming a pure lead soap, and that there is, therefore, none of that oxidization of the oil, which takes place in pigments wholly inert, etc." Here, again, we find the laws of chemistry sacrificed to lend color to the vast superiority of Red Lead over other well known paints and pigments.

The idea of Red Lead and Linseed Oil soaponifying and forming a "pure lead soap" is erroneous. A lead soap is white. Red Lead and Linseed Oil do not, when mixed together, turn white, and if an insoluble lead soap were formed then Red Lead paint, i. e., Red Lead and Linseed Oil, could not be dissolved with alkaline solutions, *but it can*, therefore it is evident, without further argument, that soaponification does not take place, as is claimed by the manufacturers of Red Lead.

The above are samples of "expert testimony" to be found in many pamphlets concerning protective paints.





Three sections of 14th Street Viaduct, Denver, Colorado, 2000 tons of structural steel protected from RUST by CARBONIZING COATING.

CARBONIZING COATING.

Manufactured Only by The Goheen Manufacturing Company, Canton, Ohio.

Makers of Technical Paints for All Purposes.

Carbonizing Coating has proved itself to be a paint unequalled as a protective covering for iron and steel, giving protection under many circumstances where all other paint has failed. Carbonizing Coating is made with one end in view, namely the *perfect protection of iron and steel* from RUST, Corrosion, acids, alkalies, and gases. There is no special mystery or patent process connected with the manufacture of C. C., but in it, is embodied the best time tried pigments combined with years of experience in handling them to produce certain results. "Carbonizing Coating" is not a "permanent" paint but will protect iron and steel from rust and corrosion for a period of from ten to fifteen years on outside exposure, and its remarkable covering capacity makes it at once the *most economical* protective paint covering in use; being a non-porous paint it hermetically seals the pores of the iron from all detrimental influences. Its efficiency on many of the most important steel structures in the country vouches for its merits as a rustless coating.

In investigating the merits of C. C., Mr. Floyd Davis, E. M., Ph. D., Des Moines, Ia., and Consulting Chemist to several Railroads, makes the following report:

FLOYD DAVIS, E. M., PH. D.,
Analytical and Consulting Chemist.

Des Moines, Iowa, May 9th, 1898.

The Goheen Mfg. Co., Canton, Ohio.

Dear Sirs:—I have completed a careful series of experiments on Carbonizing Coating, Graphite paint and Red Lead paint to determine their comparative merits for use in iron and steel structural work. My results can be summed up as follows:

First. Carbonizing Coating has much greater adhesion to iron and steel than either Graphite or Red Lead paint.

Second. Sudden changes of temperature caused both the Graphite and Red Lead paint to crack and show minute spots of separation from the steel, but the Carbonizing Coating after being thus treated had no indication of cracking, and remained as firmly on the steel as before it was heated.

Third. Before being heated, all the paints were impervious to water, but after they had been injured the Graphite and the Red Lead paint allowed water to penetrate and to corrode the steel; but the sample painted with Carbonizing Coating remained perfectly impervious to water and other liquids.

Fourth. All three paints seem about equally affected with alkalies, but the Carbonizing Coating and Graphite paint were apparently unaffected with strong sulphur and acid fumes. They were also unaffected with sulphureted hydrogen fumes, but the Red Lead was slowly destroyed by the former and changed in color by the latter, so that the paint lost its preserving power and could be quite easily removed from the steel.

These experiments show that Carbonizing Coating is an excellent covering for bridges and other exposed structures, and is a perfect protection against the atmospheric agencies, changes of temperature, acid mine waters, corroding gases from smelters, and other destructive agencies that shorten the life of steel and iron structures. It is certainly superior to Graphite and Red Lead paints, and has a greater adhesion for steel than other paints that are used. When I consider its remarkable power to withstand destructive agencies I appreciate fully its value as a coating for all bridges and other expensive structures connected with railroads.

Very truly yours,

FLOYD DAVIS.

The covering capacity is clearly shown in the following letters:

JONES & LAUGHLIN, Limited,
Structural Dept. American Iron and Steel Works.

Pittsburg, Pa., December 7, 1897.

W. H. Woodcock, Esq., Inspecting Engineer:

Dear Sir:—In reply to your letter of Dec. 4th, referring to Goheen Carbonizing Coating would say that we have used one barrel exclusively on two buildings erected in the mill. I find the covering quality remarkable, one gallon sufficient to cover a 36-inch girder 30 feet long. In another instance we used one-fourth gallon to cover five rivited struts about 10 feet long. The whole barrel covered two buildings as noted above. The exact weight I am unable to give you, but the details are approximately as follows: 20 to 25 columns with trusses, beam purlins, laterals, girders and bracing to match. *The paint going twice as far* as Graphite. I found also that the Coating dried quickly and seemed to enter the surface of the steel well, presenting (if painted properly) a smooth, even coat. Very sincerely,

(Signed) GEO. F. BAINBRIDGE.

CENTRAL LEAD COMPANY,
Flat River, Mo.

August 19, 1897.

Messrs. Garrells & Freeman, No. 3 Franklin Bank Bldg., St. Louis, Mo.

Gentlemen:—In compliance with your request to state my experience with Carbonizing Coating purchased of you, I am glad to say that I am highly pleased with it. As regards its covering capacity, I found that I was able to put an excellent coat on 1500 sq. ft. of new corrugated iron, making the cost only ten cents per square. I was able to cover between 300 and 400 square feet of corrugated iron with red mineral paint costing fifty cents per gallon, making at best 12½ cents per square. With half a gallon of Carbonized Coating I gave a good coat to 400 feet of 8 inch spiral riveted pipe. The covering was continuous and after six months of exposure to the moisture and heat of a mining shaft, shows no sign of rust coming on.

Yours truly,

(Signed) R. D. O. JOHNSON, Supt.

THE THOMPSON MANUFACTURING CO.,
Cleveland, Ohio.

September 27, 1897.

The Goheen Mfg. Co., Canton, Ohio:

Gentlemen:—We had occasion to use some of your Carbonizing Coating during July, 1897. You stated one gallon would cover at least 1,000 square feet. We painted 23,800 square feet steel roofing and used 19 gallons of the coating, which would average about 1,250 square feet to the gallon.

Yours truly,

(Signed) THOMPSON MFG. CO.,
By C. N. Thompson.

Carbonizing Coating has been put to many severe tests and has shown its usefulness. Here is a sample:

Union Club, Victoria, B. C., Oct. 1st, 1897.

Goheen Mfg. Co., Canton, O.

Gentlemen:—I have had your Carbonizing Coating tested in the Government Laboratory under severe conditions, with satisfactory results.

(Signed) EDWARD MOHUN,
M. Am. Soc. C. E.
M. Can. Soc. C. E.

SALEM WIRE NAIL CO.

Salem, Ohio, Nov. 11th, 1897.

The Goheen Mfg. Co., Canton, O.

Gentlemen:—Replying to your letter of 10th inst. We have found the paint answered the purpose and seems to stand the hot copperas solution very well. * * *

Yours truly,
(Signed) SALEM WIRE NAIL CO.,
H. H. Sharp.

THE CANTON ROLLING MILL CO.,
Offices: 66 Maiden Lane, New York; 511 Northern Bdg., Chicago.

Canton, Ohio, Aug. 14, 1899.

The Goheen Mfg. Co., Canton, O.:

Gentlemen:—In addition to our buildings being painted with your Carbonizing Coating we have our acid tank painted with it. After being exposed to the weather and acid for two years, upon examination we find it just as good as the day it was put on. In my opinion you cannot recommend it too highly for work of this kind. Yours respectfully,
(Signed) E. E. CLINE, Supt.

We could give a long list of such experiences. Suffice it to say, if you desire the highest standard of protection on iron and steel, use CARBONIZING COATING, made *only by*

THE GOHEEN MFG. CO., Canton, Ohio.

On the following page is a concise paint table showing the relative cost of different kinds of paint used on structural iron work and quantity required for Bridge Work:

PAINT TABLE.

Structure.	Span in Feet.	Weight in Pounds.	Area in Sq. Feet.	Gallons Paint Required 1st and 2nd Coats.												Carbonizing Coating.		
				Iron Oxide.		Red Lead.		White Lead.		Graphite.		Asphalt.		Carbonizing Coating		Gallons per 100 lbs. of Bridge.		Cost per 100 lbs. of Bridge, 2 Coats.
				1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	
Highway Bridge, 16 feet by 90 feet.	20	1800	400	1	¾	¾	½	1	¾	1	¾	1½	1	½	½	.028	.028	$0.08
	40	5200	800	1½	1¼	1¼	1	1½	1¼	1½	1¼	3	1½	¾	½	.015	.010	0.04
	60	10200	1400	3	2	2	1½	3	2	3	2	5	3	1½	1	.015	.010	0.04
	80	16800	2200	4½	3	3	2¼	4½	3	4½	3	7	4½	2¼	1½	.013	.009	0.03
	100	25000	3000	6	4¼	4¼	3	6	4¼	6	4¼	10	6	3	2	.012	.008	0.03
	120	34800	3800	7½	5½	5½	4	7½	5½	7½	5½	13	7½	3¾	2½	.011	.007	0.03
	140	46200	5400	11	8	8	5½	11	8	11	8	18	11	5½	3½	.012	.008	0.03
	160	59200	8000	16	12	12	8	16	12	16	12	27	16	8	5½	.013	.009	0.03
	180	73800	10000	20	14	14	10	20	14	20	14	33	20	10	7	.013	.009	0.03
	200	90000	12000	24	17	17	12	24	17	24	17	40	24	12	8	.013	.009	0.03
	220	107800	15000	30	21	21	15	30	21	30	21	50	30	15	10	.014	.009	0.03
	240	127200	18000	36	25	26	18	36	26	36	26	60	36	18	12	.014	.009	0.03
	260	148200	21000	42	30	30	21	42	30	42	30	70	42	21	14	.014	.009	0.03
	280	170800	24000	48	35	35	24	48	35	48	35	80	48	24	16	.014	.009	0.03
	300	195000	28000	56	40	40	28	56	40	56	40	90	56	28	19	.014	.009	0.03
Single Track Railway Bridge.	80	60000	4800	10	7	7	5	10	7	10	7	16	10	5	3	.008	.005	0.02
	100	85000	6800	14	10	10	7	14	10	14	10	23	14	7	5	.008	.005	0.02
	120	112000	8960	18	13	13	9	18	13	18	13	29	18	9	6	.008	.005	0.02
	140	150000	12000	24	17	17	12	24	17	24	17	40	24	12	8	.008	.005	0.02
	160	185000	15000	30	21	21	15	30	21	30	21	50	30	15	10	.008	.005	0.02
	180	226000	18080	36	26	26	18	36	26	36	26	60	36	18	12	.008	.005	0.02
	200	270000	21600	43	31	31	22	43	31	43	31	72	43	22	14	.008	.005	0.02
	220	319000	25520	51	36	36	25	51	36	51	36	85	51	25	17	.008	.005	0.02
	240	375000	30000	60	43	43	30	60	43	60	43	100	60	30	20	.008	.005	0.02
	260	429000	34320	69	49	49	35	69	49	69	49	115	69	35	23	.008	.005	0.02
	280	490000	39200	78	56	56	39	78	56	78	56	130	78	39	26	.008	.005	0.02
	300	555000	44500	89	63	63	45	89	63	89	63	148	89	45	30	.008	.005	0.02

Covering Capacity of 1 gal. in Sq. Ft	500	700	700	1000	500	700	500	700	300	500	1000	1500		
Price Per Gallon.....	$ .50		1.25		.85		.70		.40		1.50			
Cost Per 100 Square Feet.....	.10	.07	.18	.13	.17	.12	.14	.10	.13	.08	.15	.10		
Times Renewed in 20 years.....		10		3		5		7		60		1		
Cost Per 100 Square Feet for 20 years...		$1.70		0.92		1.45		1.68		12.60		0.25		
Relative Economic Value on 20 yr. basis		68		38		58		67		5		100		

NOTE—Area covered by one gallon is for finely ground Pigment, such as Carbonizing Coating or Magnetic Reds and Browns.

BUILDINGS—12 pounds iron averages 1 square foot surface=1 square foot floor surface. Add 10 per cent. for corrugations in corrugated iron.

STEEL RIVETED PIPE—Number of gallons of Carbonizing Coating per lineal foot of pipe equals sum of inside and outside diameters in inches multiplied by 0.000262 for first coat, and by 0.000174 for second coat and succeeding coats. Add 3 per cent. for laps.

For the guidance of those desiring to specify the use of "Carbonizing Coating" upon their work, we append the following specifications.

For the complete preservation of steel railroad and highway bridges and of metal structural work of all kinds from rust, etc., paint specifications should read as follows:

PAINT SPECIFICATIONS.

1. This work shall have two coats of Carbonizing Coating (manufactured by The Goheen Mfg. Co., Canton, Ohio,) applied to it; the same shall be applied without any admixture and just as received from the manufacturer.

2. Previous to applying the first coat of Carbonizing Coating, all the material shall be carefully gone over and thoroughly cleaned from Rust, Grease and Mill Scale, and in the case of cast iron work, the sand, etc., thoroughly removed. The metal shall be thoroughly dry at the time of application.

3. The first coat shall be applied in the shop under cover, and carefully brushed out to a smooth even coat, working carefully around rivet heads, etc.

4. All connecting surfaces shall have one coat of Carbonizing Coating before riveting or bolting.

5. The metal after the priming coat shall not be shipped for at least twenty-four hours. Painting on cars is *Positively Prohibited.*

6. All parts scratched or marred in handling must at once receive a second coat of paint.

7. At least five days must elapse between first and second coats.

8. On assembling of the material on the field before erection, it shall be carefully gone over, and should the Coating have been scratched, scraped or otherwise damaged in shipment, such places shall at once receive an application of the Coating.

9. Each and every portion of the work which shall, on erection, be found to require changes made thereon, shall have the coating applied according to the foregoing.

10. All crevices which will retain water or through which water can enter, must be filled with waterproof cement before the final coat of paint is applied.

11. The same care shall be taken in second coating as in the first, and the application carried out, only in weather favorable for painting.

12. We shall furnish special inspection in the matter of cleaning and applying the foregoing paint.

METAL SIDING AND ROOFING PAINT SPECIFICATIONS.

1. All material shall have two coats of Carbonizing Coating applied to it, as manufactured by The Goheen Mfg. Co., of Canton, Ohio.

2. The coating shall be applied just as received from the manufacturer without any admixture.

3. The material shall be carefully gone over before painting, and all Mill Scales, Rust and Grease thoroughly removed before the application of the paint.

4. The work of corrugating shall be done prior to the application of the first coat of paint.

5. The work of painting shall be carried out by hand, and the use of short bristle brushes is advisable, the coating being brushed out to a thin, even coat.

6. The second coat shall be applied upon erection, under favorable conditions for painting; all parts inaccessable after erection shall have the second coat prior to placing them in position.

7. We shall furnish special inspection of the application of the painting.

THE PAINTING OF GALVANIZED IRON.

Difficulty has been experienced in getting ordinary paint to adhere satisfactorily to Galvanized surfaces; in fact an ordinary linseed oil paint suitable for preserving and beautifying wood, iron or steel, does not meet the requirements of galvanized iron. The combination of the zinc and tin and the acid baths the iron is subjected to in the process of manufacture has much to do with the repelling, sweating and pealing off of ordinary paint on galvanized surfaces. After continued experimenting and time testing, we introduced our "*Galvanum*" which is prepared specially for galvanized work, and since its introduction about seven years ago, has fully verified all our claims for it, and is the only paint that will adhere satisfactorily for a lengthened period to galvanized iron.

GALVANUM is made in two colors only, but as it forms a perfect base for repainting, any colored paint can be applied over it.

In making out paint specifications for galvanized work, specify plainly "Galvanum," manufactured only by The Goheen Mfg. Co., Canton, Ohio. By so doing you will have the only durable protective paint for galvanized work.

The Goheen Manufacturing Co.

CANTON, OHIO, U, S. A.

Only Makers of

CARBONIZING COATING

For the Perfect Protection of Iron and Steel Construction.

Also Manufacturers of Technical Paints for All Purposes, Including Red Lead, White Lead, Carbon, Asphaltic, Iron Oxide, Magnetic, Galvanum, Etc.

Railroad Specifications and Special Formulas Given Careful Attention.

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NEW YORK CITY,
PITTSBURG,
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THE GOHEEN MANUFACTURING CO.,

CANTON, OHIO, U. S. A.